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ABSTRACT

Management of information services requires managerial control of information about the service itself. A critical factor for information managers that affects their ability to provide service is their own competence at handling management information, i.e., information concerning and describing the performance, income, and expenses of their services. Successful operation of fee-based information retrieval services in the not-for-profit academic sector places considerable administrative pressure on mid-level managers. Balancing cost-recovery against demands for effective results within traditionally free information services requires that managers gather, collect, and evaluate a variety of information about information services. This paper applies the principles of Management Information Systems to the administration of Information Retrieval Services applicable to both profit and not-for-profit services encompassing cost analysis, inventory control, overhead and capital expenses, staff development and marketing, and evaluation of services. (Author)

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APPLICATION OF THE PRINCIPLES OF MANAGEMENT INFORMATION SYSTEMS TO INFORMATION RETRIEVAL SERVICES IN NOT-FOR-PROFIT ACADEMIC LIBRARIES

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Abstract

Management of information services requires managerial control of information about the service itself. A critical factor for information managers, that affects their ability to provide service, is their own competence at handling management information, i.e., information concerning and describing the performance, income, and expenses of their services. Successful operation of fee-based information retrieval services in the not-for-profit academic sector places considerable administrative pressures on mid-level managers. Balancing cost-recovery against demands for effective results within traditionally free information services requires that managers gather, collect, and a evaluate a variety of information about information services. This paper applies the principles of Management Information Systems to the administration of Information Retrieval Services applicable to both profit and not-for-profit services encompassing cost analysis, inventory control, overhead and capital expenses, staff development and marketing, and evaluation of services.

APPLICATION OF THE PRINCIPLES OF MANAGEMENT INFORMATION SYSTEMS TO INFORMATION RETRIEVAL SERVICES IN NOT-FOR-PROFIT ACADEMIC LIBRARIES

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As libraries began adopting online information services the primary concern was most often making the program a success in the eyes of staff and users. Key to this success was user and staff satisfaction with the functioning of the process. Following these initial concerns librarians and information managers came, or are coming now, to be concerned with the various issues centering around the successful management of such services. Whereas traditional library service did not require a continuous outlay of funds for continued research via bibliographic access, online information services make precisely those demands. Whether managing for cost recovery or managing to provide service from subsides in a budget-based institution, it is imperative that the information manager work within the structure of a well-developed, closely monitored management information system (MIS).

It is from within the heritage of traditional library service that the demand for performance of information service emanates. But it is also a probable truism that until the emergence and subsequent widespread use of online services that performance was measurable only in a rather oblique, if not

obscure, manner centering on subjective notions and perceptions such as "user satisfaction" or collection "effectiveness". In a typical online information environment users are served singly, one-on-one with the search analyst. The end-user is usually expected to make a financial commitment of some sort in compensation to the institution for extending the service. Perhaps no current social or political force is more universally meaningful to library users and other information consumers than is the economic force. This economic force now is keenly focused on the output of the information retrieval service (IRS). On-going debates, polemics, and diatribes decry the selling-out of the notion of the free library and prompt allegations of denied access to the economically disadvantaged as well as suggestions of the prostitution of our principles. However strongly the antagonists may rail against the insidious nature of pocket-book information services the reality of library and information services are not reduced by their passion. Extended, technology based information services, especially those designed for the advanced researcher, and requiring specialized equipment, training and intellectual capabilities are, without doubt, expensive undertakings, whether that expense be measured from the point of view of the producer of the information, the user of the information, or the search analyst in the library setting who provides the bridge between the user and the producer. Deciding information policy is not the topic of this paper, though providing for the effective management of the service is.

If the pressures of human interaction and accountability coupled with economic forces were not sufficient, we would also need to consider the political and budgetary forces at work within service institutions that contribute to performance management issues. With the continuing reduction or elimination of sources of external funding or subsidy and with the increasing demands and competition for internal funding allocation and re-allocation subject to general inflationary pressures, institutional performance demands become critical to the success of all service enterprises and, of particular interest on this occasion, to the success of information retrieval services.

As we consider the not-for-profit, budget-based service institution to be a vital force in modern society and that the online IRS is perhaps the archetype for future information dissemination activities, it is imperative that we affirm that such operations are manageable, that they can be managed to fulfil performance criteria, and that we can learn valuable managerial tasks appropriate to information management in both the near- and long-term.

Information Retrieval Services: Characteristics and Management Issues

It is important to review, at this point, the characteristics and problems common to the IRS in the budget-based, service institution. The budget-based service institution

characteristically works within the framework of a fixed budgeting allocation as its basis for operation. That budget is generally established in anticipation of the budget period and its planning generally precedes that interval by several months if not one year or more. In a volatile enterprise such as on-demand online information retrieval it may be impossible to adequately predict service demands at all and certainly not when considering a year-long budget period itself a year in the future. Working exclusively within a fixed budget base would require extreme policy maneuvers and critical decision making to successfully complete a year with a budget squarely on-target.

There may be some small solace to be had in the belief that once the budget is fixed, it is generally not reduced, though that is not always the case either. The obvious temptation would be to intentionally over-budget to guarantee service, but those tactics are not generally successful more than once or twice, even under lax audit control, and eventually will be seen as counter-productive if not disastrous to the service.

Being not-for-profit certainly does not preclude user-fees for cost-recovery, but does call upon management to carefully consider the policy, means, and basis upon which cost-recovery procedures are used. Though providing a means of continuous revenue creation and certain opportunities for a fiscal face-lift of this micro-economy, excessive recovery of costs indicates a poor cost-performance-benefit analysis that demands review. Similarly defective are cost-recovery mechanisms that fall short

of need unless open subsides are the rule.

Whether the foregoing general characteristics are evident singly or together, nearly all such institutions are governed by the accounting practice which will call back or absorb any and all unencumbered capital at the close of the fiscal period. This practice precludes long-term planning options outside the budget-base, makes cost-recovery a year-only proposition, and entirely eliminates any thoughts of a service nest-egg. If that were not enough, deficits are carried-over, generally, to the next fiscal budget and can have serious impact on the fiscal base and the service it is designed to support.

This rather dismal fiscal policy picture should serve to emphasize the need for careful evaluation and understanding of the costs and their means of fiscal balance. A complete cost-analysis of expenses related to an IRS follows and is divided among three categories, capital expenses, supply costs, and operational costs.

Capital expenses, sometimes referred to as general, start-up or "one-time" costs concern mainly equipment and related factors. This includes the terminal and installation, a MODEM or acoustic coupler and installation, telephone and installation, site preparation, initial staff training, initial library of supporting documentation, electrical equipment, office equipment. Expenses in this category are summarized in Table 1. Though all these costs are capital in nature and general in their usage, they are not really "one-time" outlays. All of the foregoing

TABLE 1

Information Retrieval Service

CAPITAL EXPENSES

Terminal
and Installation

Telephone
and Installation

Acoustic Coupler or MODEM
and Installations

Site Preparation

Staff Training

Support Documentation

Electrical Equipment

Office Equipment

will eventually require replacement, up-dating, or renewal due to wear or obsolescence.

Supply costs, sometimes know as consumable or viable costs, account for the various general office supplies needed, such as paper, ribbons or ink for the printing device, on-going training needs, subscriptions to journals, loose-leaf services, manuals, and utilities and office overhead, e.g., telephone monthly rental and long distance charges. Also to be considered in this category are the nature and extent of marketing and demonstration activities which can be costly. These costs are prone to variances in the market and activity and can only be estimated in vitro. A summary display is shown in Table 2.

A performance/demand model for each service unit will eventually emerge from the experiential base, though the introduction of services will be attended by considerable ambiguity on the supply side.

Operational costs are those expenses, variable in nature, directly attributable to online searching per se. These include system use charges (connect time), database royalties, printing (and mailing) charges, telecommunication for searching. These costs, identified in Table 3, are extremely volatile depending as they do on the level of demand and the nature of the request. This suggests why these costs are most easily identified as recoverable, that is charged-back to the end-user or search requestor/client.

A separate cost factor is that of staff salary. Many

TABLE 2

Information Retrieval Service

SUPPLY COSTS

(Consumable/Variable Costs)

General Office Supplies

On-going Training Program

Subscriptions to Journals,
Loose-Leaf Services and Manuals

Utilities and Office Overhead
e.g. Telephone Costs

Marketing and Promotional Activities

TABLE 3

Information Retrieval Service

OPERATIONAL COSTS

System Use Charges - Connect Time Fees

Databases Royalties

Printing and Mailing Charges

Telecommunications Costs

institutions, when beginning online operations converted existing staff positions wholly or in part to create a new position internally subsequently designated as the information retrieval librarian or search analyst. Though relatively easily accomplished from an administrative point-of-view, this tends to obscure the true impact on the IRS, the larger administrative unit (usually the library), and the organization as a whole. It is not an uncommon policy that staff positions are considered bought-and-paid-for from the general institutional salary base. However, an accurate cost analysis should include this salary figure and related fringe benefit costs in the analysis of service costs. Table 4 illustrates these cost factors. This consideration is compounded by additional staff, full or part-time and ranging from the manager/analyst to clerical/support staff whose responsibilities may have expanded to include these added duties. Thorough cost analysis practice dictates that full costing is the appropriate mode of costing the service. Though relatively unpopular from philosophical or practical standpoints, it is, nonetheless, accurate and a far more realistic means of assessing the cost and contribution of the service to the institutional effort.

The foregoing explication of the major cost factors in online searching is largely complete though there may be other factors of local significance. These expenses, summarized in toto in Table 5, form the basis from which management information is selected and utilized and upon which budgets are projected,

TABLE 4

Information Retrieval Service

STAFF SALARY COSTS

Service Manager

Search Analyst (s)

Support Staff

Salary + Fringe Benefits x Per Cent Time = Staff Cost

TABLE 5

Information Retrieval Service

COST FACTOR SUMMARY

Capital Expenses

Supplies

Operational Expenses

Salaries

services planned and operated, and costs recovered. It is the management of this information that is crucial to service performance.

MANAGEMENT INFORMATION SYSTEMS IN THE LIBRARY: A BRIEF, THEORETICAL ASIDE

Though a commonly understood organizational performance mechanism in many business and corporate structures, management information systems and their alliance with management by objectives (MBO) is less commonly experienced in the library environment. Figure 1 displays a not uncommon representation of a general structure of the MIS/MBO performance environment as could be superimposed on the traditional library environment. Figure 2 more readily instantiates this relationship with the identification of standard or common position designations and seeks to illustrate the functional activities and role responsibilities inherent in those positions. From the top, strategic planning and ultimate decision making are advanced. It is true, in technology-centered enterprises, where the technical decisions are made by specialists in the technology, the strategic planning responsibilities at the upper echelons appear to declining, deferring to the insight and skill of the technocrats, what some have termed the "new mandarins." The decision making may be no more significant than the approval of proffered options. Still, these options were, no doubt, developed within a framework of constraint ordained by either the decision to pursue the project or the designation of delimiters of action specified by the director in contact with fiscal, political or organizational reality, or all of the above.

FIGURE 1

MANAGEMENT INFORMATION SYSTEMS

GENERAL STRUCTURE

STRATEGIC PLANNING

MANAGEMENT CONTROL

OPERATIONAL CONTROL

TRANSACTION PROCESSING

FIGURE 2

LIBRARY M I S RESPONSIBILITIES

STRATEGIC PLANNING

Director and Associate Director

Management Information for Policy, Planning and Decision Making

Responsible for organizational data base for budget, costs and planning

MANAGEMENT CONTROL

Department Heads

Tactical Planning and Decision Making

Staffing, scheduling, equipment, setting priorities, evaluation and analysis

OPERATIONAL CONTROL

Public Service Activity Managers

Operational supervision and decision making, quality control, timely reporting

TRANSACTION PROCESSING

Public Service Staff

Task performance, record keeping, routine reporting

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MIS/IRS: APPLICATIONS

It is the nature and function of management information systems to provide the basis for managerial activity in three general categories: 1) planning, both operational and strategic, to provide purposeful direction for the service; 2) organizing the structure, physical design and formal relationships of authority and responsibility; and, 3) controlling performance in relation to standards, criteria, evaluation and corrective action. Of these three facets it is the latter that is of single greatest importance to the IRS being described and will be covered in some detail; it is useful though to remember all of these functions and especially important to be mindful of their interaction.

Operational and strategic planning begin prior to the commitment to initiate online service and continues throughout. Briefly put, operational planning, as illustrated in Table 6, answers the question of "how to provide for an IRS?" and strategic planning, Table 7, inquires "what is expected of the IRS in one, five and ten years hence?" Of necessity these questions revolve around initial and eventual aspects of products, services, markets, funding options, institutional policy and conflict, competition, and impact within and throughout the information service and parent institution. The providing of goals and objectives is manifest at this level.

TABLE 6

OPERATIONAL PLANNING

"How is the service to be provided?"

Type Of Service

What Is The Market

Funding Source Options

Policies

Impact

"GOALS"

TABLE 7

STRATEGIC PLANNING

"What is expected of the service over time?"

Service Developments

Market Growth

Future Funding

Policy Changes

Impact Implications and Changes

"OBJECTIVES"

Though closely allied to planning and equally prior in its importance, organizing is multifaceted and more operationally active in terms of day-to-day function. Within the framework of the IRS, organizing seeks to detail the structure of the service within the larger information activities, provide for the physical activity of the IRS, and describe the individual task and duty assignments among all those involved. These points are illustrated in Table 8. Essential to this process in practice is the line of responsibility to insure a proper flow of work and the authority to ordain compliance with standards or adjust for short-comings and variations in performance and service output. The need for modification is certainly not limited to the implicit inadequacies of the search analyst staff though reflection on the previous statement may have suggested that. More often than not, as has been the authors experience, the wide variety of influences for change, procedural modification and policy review have been occasioned by external influences, most notably from the client/user base. Task assignments would include those actually searching, those functioning in support of search services, e.g., bookkeeper, general clerical, cashier/dispensing agent, ancillary staff on spot assignment, and direct and general supervision of those actually functioning in the IRS activity itself.

Managing for performance control is probably as diverse in its information component as it is vital to the service itself. Providing standards for performance is closely related to

TABLE 8

ORGANIZATIONAL PLANNING

Details Of Service Structure

Provide For The Actual Service

Task And Duty Assignments

Work Flow

Authority To Make Changes

Budgetary Compliance

"PRACTICES"

planning and organizing as well. Performance criteria and their evaluation along with comparative measures to standards are the principal mechanisms by which to judge the performance of the IRS. Corrective action as needed generally should follow such measures. Evaluation of performance and obedience to fiscal constraints are central issues in control planning and are illustrated in Table 9.

Initially, performance standards and criteria many not be readily available for use in the local setting and as a result may be "borrowed" from elsewhere. Within a short span of time, though, local characteristics will appear and provide more meaningful information. Standards may be as simple as the IRS response time to a search request (e.g., within 24 hours) or an expected relevance ratio (e.g., 80%) or as extensive as analyses of the ratios of search variable inputs to retrieved citation outputs. Each institution must establish its own performance criteria to reflect local practice but certainly cost, retrieval effectiveness, database selection and use and patron characteristics are fundamental.

The importance of performance control cannot be over-emphasized. System performance is the most visible (to the user) and sensitive (to economic and other forces) aspect of the IRS. Certain facets of the performance control MIS are clearly user orientated: total cost, cost per citation (cost-effectiveness), response time both within the IRS and with the remote system, scope, coverage, recall, relevance and precision. All of these

TABLE 9

CONTROL PLANNING

Provide Standards For Performance

Evaluation Of Activity

Service Output

Apply Budget Practice

Market Assessment

"EVALUATIONS"

TABLE 10

MIS
Summary

"GOALS"

Operational
and
Strategic Planning

"OBJECTIVES"

Organizational Planning

"EVALUATIONS"

Control Planning And Performance

Individual Service Queries And Transactions

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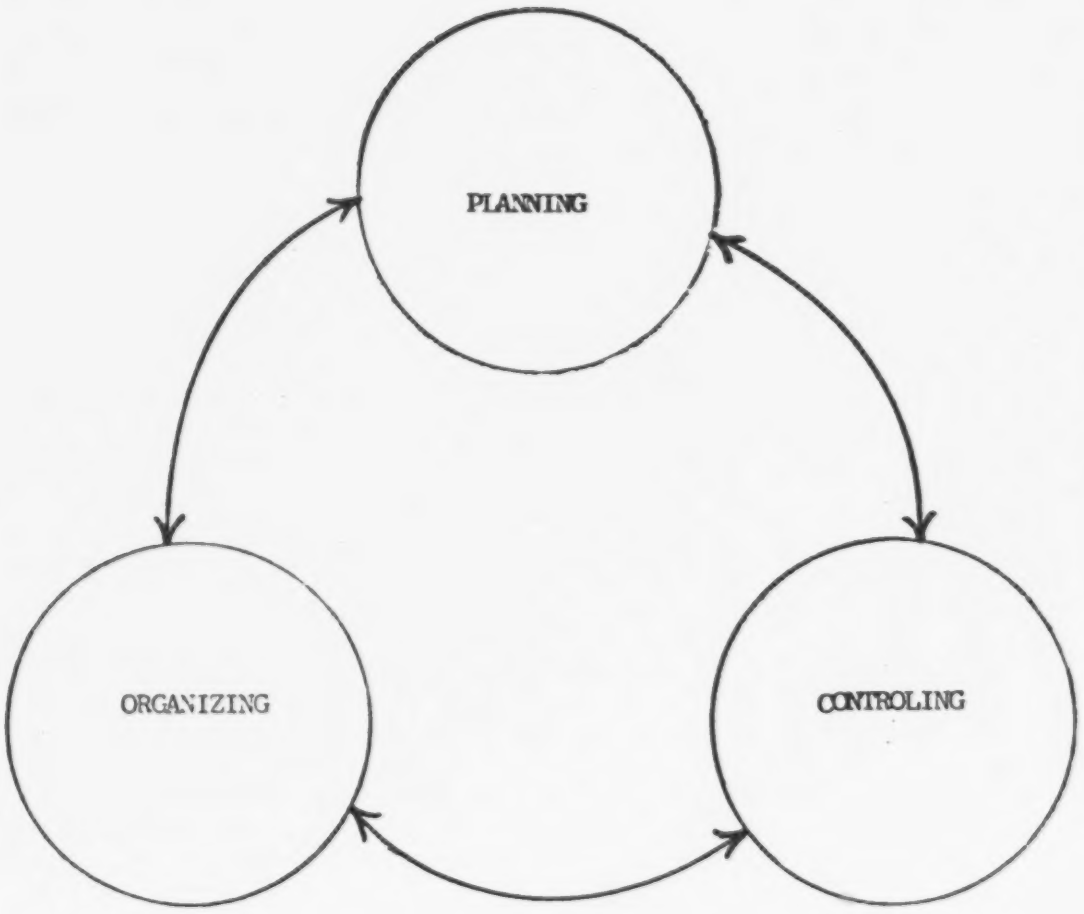
factors need continuous monitoring and comparison to performance standards as a means of insuring user satisfaction.

IRS personnel must also collect data on users, their type and distribution, the diversity of subjects, characteristics of system and database use, the types of service demand (online/offline, bibliographic/numeric, etc.). This data is invaluable in determining the need for searcher training, staff assignment, equipment needs, marketing needs and general database demands. It is at this point that performance control directly affects planning and organizing activities. This managerial triad, as depicted in Table 11, is truly interactive, each portion affecting the others. Though there need be no overwhelming harmony in their dynamic interaction they should function without discord.

Returning to our IRS/MIS/MBO construct, we can first summarize the cost categories of operations as shown in Figure 3. It will be the strategic and tactical decisions, vested in the responsible levels of the organizational decision-making structure to include or exclude any or all categories of identifiable cost. These decisions and the revenue/cost implications of each incremental decision will be implicit or explicit enunciations of organizational policy and "philosophy."

Collectively, these categories will determine the "cost of operations" as shown in Figure 4. When these costs are divided by the number of transactions within a reconciled time interval, the "cost per transaction" will be identified. Each subordinate

TABLE 11



COST CATEGORIES

EXAMPLE: INFORMATION RETRIEVAL SERVICES

DIRECT VARIABLE COSTS

- ONLINE CHARGES FROM VENDOR
- COMMUNICATIONS CHARGES
- PRINTING COSTS
- [SALARIES, BENEFITS, SUPPLIES, OPERATIONAL COSTS]

DIRECT FIXED COSTS

- EQUIPMENT MAINTENANCE
- SERVICE / SYSTEM DOCUMENTATION
- TRAINING
- TELEPHONE SERVICE

INDIRECT FIXED COSTS

- EQUIPMENT DEPRECIATION AND AMORTIZATION
- SUPERVISION AND ADMINISTRATIVE SUPPORT
- BUILDING COSTS -- INSURANCE, MAINTENANCE, UTILITIES

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modified from Boyce, 1983

decision (Figure 4) has an abundance of concomitant influencing dynamics that can range from obvious to elusive in character. Attempting determinism amidst this level of ambiguity can be frustrating; this uncertainty is frequently manifest in the avoidance of the process altogether. While this may be a comforting and gentle ignorance, we cannot avoid the observation that it is a policy and procedure that is, in practice, ultimately problematic.

Some fiscal salvation may be realized when, as shown in Figure 5, the costs of operations are compensated by the identification and collection of revenues. This revenue base, whether it be by the use of external support, identified subsidies, or some sort of fee or cost recovery mechanism can reduce the negative impact of operational costs. Revenue-adjusted costs, i. e. reducing costs by subtracting (which is actually adding!) revenues, subsequently divided by the number of transactions, renders a net cost per task. In the case of the not-for-profit, budget-based academic library, the answer then provided can be, should be, understood as the expected level of fiscal commitment of the library to the service thus provided. Individually it is found to be a directed subsidy to the service client; collectively it is a broad-based subsidy to the service itself. Rarely is this seen for what it is; namely, a highly specialized, high-cost, directed subsidy of specialized users. It is often clouded or obfuscated by the payment of token fees or reimbursement of some easily-identifiable costs. If the truth

FIGURE 4

COST ANALYSIS FORMULAE

BASIC

$$\frac{\text{cost of operations}}{\text{number of transactions}} = \text{cost per transaction}$$

DECISIONS:

1. Which costs?
2. Identify transaction?
3. Account for revenues?

DYNAMICS:

1. all, some direct/indirect?
2. weight by demand/type?
3. relate to costs? use of span and scope of assignment?

FIGURE 5

COST ANALYSIS FORMULAE

$$\frac{\text{COST OF OPERATIONS (DIRECT \& INDIRECT BY TASK) MINUS REVENUES}}{\text{TRANSACTIONS BY AREA, WEIGHTED BY TYPE}} = \text{COST PER TASK}$$

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were known, most organizations, that is most academic libraries, are unconsciously financing, via indirect, implicit and largely hidden subsidies for more cost per service that they recover through the imposition of so-called prejudicial and exclusionary user fees.

It is not difficult to foresee how sophisticated such analyses could become. It is even less difficult to understand how a profession, not given to numerical analysis will probably continue to avoid and disdain such analyses. An additional factor which compromises success in these endeavors is that total cost analyses are frustrated at the information side. It is found in all-too-many organizations that uncovering costs of total operations, let alone for specific activities is difficult to account owing to the "burial" of costs within budgets and the reluctance to adequately analyze activities for their partition of time on task. Suggested here is the need for a) closer control of cost information, b) clearer practices of cost-to-service attribution, c) time-on-task systems analysis, and d) the predisposition to scientific management, cost control and management by objectives firmly grounded in an effective management information system.

Conclusion and a Prospectus

Referring again to Table 10 it is important to understand the hierarchial arrangement of the levels of authority,

responsibility, and interaction of an effective management information system. The array of information needs that permeates the information system has as its foundation the control, planning, and performance characteristics of the information retrieval service. These evaluations, and the analyzed data upon which they are based, will influence and modify not only performance actions themselves, but organizational planning also. Specifically, such information should contribute to the modification of operational objectives. Over time these objectives will either fulfill the original goals or necessitate the change of those goals to more closely respond to the demands of the operant environment. This rather inverse description of a traditional management-by-objectives (MBO) structure (i.e., from goal to objective to action) with an intentional emphasis on the operational function and activity of the information retrieval service is no accident. Volatile and dynamic services cannot be reliably pre-ordained in today's environment. To remain viable services that are cost-effective and valuable to the user require that the emphasis be placed on the performance side.

This paper had as its goal the demonstration of the appropriate linkage between a traditional Management Information System to the function of the typical Information Retrieval Service. Managerial control is essential to successful IRS operations and planning. An MIS serves not only to provide for the means of current performance evaluation but the necessary insight for planning service changes and enhancements.

Considerable work must still be forthcoming to provide the criteria and standards of performance as well as more effective means of forecasting and modelling.